

WHAT IS CLAIMED IS:

- 1 1. A system for acquiring position information relevant to a specific axis
2 comprising:
 - 3 a movable apparatus having first and second reflective faces at
4 a side associated with a parallel to said specific axis, said first reflective face
5 being at an angle to said second reflective face and said first and second
6 reflective faces being non-parallel to said specific axis;
 - 7 an interferometer positioned to direct a first beam for impinge-
8 ment of said first reflective face and to direct a second beam for impingement
9 of said second reflective face, said interferometer including a beam combiner
10 aligned with a detector; and
 - 11 beam-steering members located with respect to said
12 interferometer and said first and second reflective faces to manipulate said
13 first and second beams to reach said beam combiner without a beam path
14 segment that varies in length in unity with displacements of said movable
15 apparatus along said specific axis.
- 1 2. The system of claim 1 wherein said first and second reflective faces are
2 surfaces that are angled such that beam paths of said first and second beams
3 vary in opposition when said movable apparatus is displaced along said
4 specific axis.
- 1 3. The system of claim 2 wherein said interferometer is configured to
2 generate said first and second beams and to direct said first and second
3 beams at a generally perpendicular angle with respect to displacement of said
4 movable apparatus along said specific axis, said first and second reflective
5 faces being oppositely angled as measured with respect to said perpendicular
6 angle.

1 4. The system of claim 1 wherein said beam-steering members are mirrors
2 that are positioned such that, when said movable apparatus is in a symmetry
3 position on said specific axis, each beam path segment in which said first
4 beam either impinges or has been reflected from said movable apparatus is
5 symmetrical to a corresponding beam path segment of said second beam.

1 5. The system of claim 4 wherein said beam-steering members include first
2 and second beam-return mirrors respectively aligned with and oriented to
3 said first and second reflective faces to define return beam path segments,
4 said first beam thereby reflecting from said first reflective face to said first
5 beam-return mirror and being reflected back to said first reflective face, said
6 second beam thereby reflecting from said second reflective face to said
7 second beam-return mirror and being reflected back to said second reflective
8 face.

1 6. The system of claim 5 wherein said first and second beam-return mirrors
2 are in any orientation and are selected from at least one of the following
3 types: reflective components, including plane mirrors and roof mirrors,
4 refractive components, diffractive components, and holographic components.

1 7. The system of claim 1 wherein said movable apparatus is a support stage
2 within a wafer lithography system having a lithography optical axis, said
3 support stage being mounted for movement in directions perpendicular to said
4 lithography optical axis and for movement aligned with said lithography optical
5 axis, said specific axis being said lithography optical axis.

1 8. The system of claim 7 wherein said interferometer includes a laser source
2 and a beam splitter that are cooperative to emit said first and second beams
3 with differences in at least one of frequencies and polarization.

1 9. The system of claim 6 wherein said beam-steering members remain
2 beyond reaches of said support stage in said X and Y directions as said
3 support stage is displaced.

1 10. A method of utilizing an interferometric system to acquire position
2 information of a movable apparatus along a specific axis comprising:
3 directing first and second beams to impinge said movable
4 apparatus;
5 manipulating said first and second beams via reflections such
6 that each beam path segment in which said first beam either impinges or has
7 been reflected from said movable apparatus is symmetrical to a correspond-
8 ing beam path segment of said second beam when said movable apparatus is
9 in a beam symmetry position along said specific axis;
10 combining said first and second beams as a basis for interfe-
11 metrically acquiring said position information.

1 11. The method of claim 10 wherein directing said first and second beams
2 toward said movable apparatus is a step in which said first and second beams
3 are optically distinguishable with respect to at least one of frequency and
4 polarization and wherein said movable apparatus is a wafer stage.

1 12. The method of claim 11 wherein manipulating said first and second
2 beams includes positioning mirrors to define said beam path segments in
3 which said first and second beams either impinge or have been reflected from
4 said wafer stage, including locating said mirrors beyond ranges of motion of
5 said wafer stage in directions perpendicular to said specific axis, said wafer
6 stage including first and second reflective faces in alignment with said beam
7 path segments.

1 13. The method of claim 12 wherein positioning said mirrors includes
2 selecting said mirrors from at least one of the following types: reflective
3 components, including plane mirrors and roof mirrors, refractive components,
4 diffractive components, and holographic components.

1 14. The method of claim 10 wherein manipulating said first and second
2 beams is implemented without maintaining a beam path segment that is
3 parallel to said specific axis and that varies in length with displacement of said
4 movable apparatus along said specific axis.

1 15. The method of claim 14 wherein manipulating said first and second
2 beams includes providing said movable apparatus to include first and second
3 reflective faces that are oppositely sloped with respect to a plane perpen-
4 dicular to said specific axis.

- 1 16. A system for acquiring position information relevant to a specific axis
- 2 comprising:
 - 3 a wafer stage movable in X and Y directions and in a perpendicular Z direction, said Z direction being aligned with a lithography exposure
 - 4 axis, wherein a perimeter is defined by extremes of travel of said wafer stage
 - 5 in said X and Y directions, said wafer stage having first and second surfaces
 - 6 on a side thereof:
 - 7 a source of first and second beams, said first beam being
 - 8 directed to reflect from said first surface and said second beam being directed
 - 9 to reflect from said second surface;
 - 10 a plurality of optical members arranged to define first and
 - 11 second beam paths for said first and second beams following reflections from
 - 12 said first and second surfaces, said optical members being located beyond
 - 13 projections of said perimeter in said Z direction, wherein both of said first and
 - 14 second beam paths vary in length when said wafer stage is moved in said Z
 - 15 direction;
 - 16 a beam combiner at ends of said first and second beam paths to
 - 17 combine said first and second beams; and
 - 18 a processor operatively associated with said beam combiner for
 - 19 acquiring interferometry-based determinations regarding movements of said
 - 20 wafer stage in said Z direction.
- 1 17. The system of claim 16 wherein said source emits said first and second
- 2 beams having different frequencies and different polarizations.
- 1 18. The system of claim 16 wherein said optical members include a first
- 2 mirror aligned with and oriented to said first surface of said wafer stage to
- 3 redirect said first beam back to said first surface, said optical members further
- 4 including a second mirror aligned with and oriented to said second surface of
- 5 said wafer stage to redirect said second beam back to said second surface.

1 19. The system of claim 18 wherein said first and second surfaces of said
2 wafer stage are oppositely sloped with respect to a plane perpendicular to
3 said Z direction.

1 20. The system of claim 19 wherein said opposite slopes are such that said
2 first and second beam paths vary in opposition when said wafer stage is
3 moved in said Z direction.

1 21. The system of claim 18 wherein said first and second mirrors for
2 respectively redirecting said first and second beams are in any orientation and
3 are selected from at least one of the following types: reflective components,
4 including plane mirrors and roof mirrors, refractive components, diffractive
5 components, and holographic components.